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ABSTRACT

This report provides a comparative cost analysis of three different methods of developing final examinations for secondary schools in the Montgomery County Public Schools, Maryland. Based on expenditure reports and interviews with central and school-based staff, cost estimates were developed for three kinds of exams: (1) the county-wide final exam/departmental exam approach mandated by Senior High School Policy; (2) departmental final exams alone; and (3) final exams made by individual teachers. The study found that the Board-mandated approach is by far the most expensive of the three alternatives, costing from 30 to 150 percent more than the other approaches. It should be noted that over 95 percent of the costs which were recorded in this analysis were not incremental or out-of-pocket costs but rather were "opportunity costs" resulting from (1) providing teachers with a half day of release time each semester to work with their colleagues on jointly developed departmental exams, (2) teachers spending additional time developing final exams, and (3) allocating roughly 25 percent of academic subject coordinator time and 1150 equivalent days during the previous summer to the development of uniform countywide exams. (Author/BS)

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MONTGOMERY COUNTY PUBLIC SCHOOLS
Rockville, Maryland

ANALYSIS OF THE COSTS OF THE PILOT FINAL EXAM PROGRAM

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February, 1983

Edward Andrews
Superintendent of Schools

MONTGOMERY COUNTY PUBLIC SCHOOLS
Rockville, Maryland

ANALYSIS OF THE COSTS OF THE PILOT FINAL EXAM PROGRAM

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SUMMARY

This report provides a comparative cost analysis of three different methods of developing final examinations for secondary schools in MCPS. Based on expenditure reports and interviews with central and school-based staff, cost estimates were developed for three kinds of final exams: the countywide final exam/departmental exam approach mandated by the Senior High School Policy, departmental final exams alone, and final exams made by individual teachers. The study found that the Board-mandated approach is by far the most expensive of the three alternatives, costing from 30 to 150 percent more than the other approaches.

However, it should also be noted that over 95 percent of the costs which were recorded in this analysis were not incremental or out-of-pocket costs but rather were "opportunity costs" resulting from a) providing teachers with a half day of release time each semester to work with their colleagues on jointly developed departmental exams, b) teachers spending additional time developing final exams, and c) allocating roughly 25 percent of academic subject coordinator time and 1150 EYE days last summer to the development of uniform countywide exams.

BACKGROUND

On February 12, 1980, the Montgomery County Public Schools (MCPS) Board of Education adopted a policy statement on The Senior High School (Resolution No. 161-80). In addition to providing staffing guidelines regarding MCPS's responsibilities in educating high school students, the Board of Education specifically provided for the development and administration of two kinds of final examinations in all major high school subjects: school-based departmental examinations and uniform countywide examinations. In addition, because of the many questions which were raised about these uniform countywide examinations, the policy established a three-year pilot project during which the new examination procedures would be developed, refined, and evaluated for English and mathematics. At present, this pilot is in its third and final year of operation.

In December, 1982, the newly elected Board of Education asked the Department of Educational Accountability (DEA) to conduct a preliminary cost analysis of the countywide examination process to date and to present the results at the February 8, 1983, Board meeting. It was acknowledged at that time that because of the limited time frame only a limited amount of data could be collected, and analyses would have to be based largely on reports of mathematics staff involved in the administration of a math exam in June, 1982, and English staff preparing for the administration of the pilot English exams in January, 1983. (See the Technical Appendix for a description of the data collection procedures.)

STUDY QUESTIONS

The basic questions which the study was designed to address were:

- What are the costs associated with the development and administration of uniform countywide examinations?
- How do these costs compare with those of other types of examinations such as departmental exams or teacher made exams?
- What are the long-range implications of continuing to develop uniform countywide examinations in their current form?

To address these issues, data were gathered on the following cost components for each of the categories of exams listed above:

- Test development
- Preparation for test administration
- Materials
- Scoring

These data were then used to estimate total costs for current exams in Geometry B, Introduction to High School English, and Narrative-Drama as Literature I as well as to project the costs of extending the pilot to all secondary English and mathematics courses. The appendix presents greater detail on the costing methodology which was used.

FINDINGS

The study's findings are divided into three sections: what was learned from the study about the estimated costs of administering the final examinations in English and mathematics, the relative costs of each of the components of the alternative testing procedures, and cost projections for a full-blown final exam program in English and mathematics based on these data.

Estimated Costs for Pilot Exams

Tables 1 and 2 present the findings on costs for the pilot programs in Geometry B, Introduction to High School English, and Narrative-Drama as Literature I (see columns entitled "Uniform Portion" and "Dept. Portion"). In addition, costs for exams in other English and mathematics courses not included in the countywide pilot program are also presented in the columns entitled "Other Dept. Exam" and "Teacher-made Exam." The tables show the following:

- Under the pilot system, the estimated costs for a single countywide final exam were $57,550 in English and $34,400 in mathematics.
- Comparison of these figures with those for teacher-made exams or departmental exams alone shows that the current plan is clearly the most costly. In English, the pilot program is approximately 150 percent more costly than teacher-made exams ($57,650 vs. $23,800) and 30 percent more costly than departmental exams alone ($57,650 vs. $44,426). In mathematics, the pilot program is almost 50 percent more costly than teacher-made exams ($34,400 vs. $23,309) and 33 percent most costly than departmental exams ($34,400 vs. $25,858).

TABLE 1

Total Costs of Three Type of Final Exams in English*

		Total Cost
Total Countywide Exam		$57,350
Uniform Portion	11,693	
Dept. Portion**	45,857	
Other Dept. Exam**		44,426
Teacher-made Exam***		23,800

*Based on an enrollment of 3,400 students, the actual enrollment of Introduction to High School English and Narrative-Drama as Literature I in the fall of 1982.

**The slight difference in the costs of the "departmental portion" of the countywide exam and the "other departmental exams" is probably accounted for by the extra time needed to "wrap" the departmental exam around the countywide portion.

***This assumes there is an average of two teachers per school teaching a course.

TABLE 2

Total Costs of Three Types of Final Exams in Mathematics*

		Total Cost
Total Countywide Exam		$34,400
Uniform Portion	7,298	
Dept. Portion**	27,102	
Other Dept. Exam**		25,858
Teacher-made Exam***		23,309

*Based on an enrollment of 5,600 students, the actual enrollment of Geometry B in the spring of 1982.

**The slight difference in the costs of the "departmental portion" of the countywide exam and the "other departmental exams" is probably accounted for by the extra time needed to "wrap" the departmental exam around the countywide portion.

**This assumes there is an average of two teachers per school teaching a course.

Component Costs

Tables 3 and 4 show the relative costs of each of the four components of the testing procedure examined: development, preparation, materials, and scoring. The data show the following:

- Generally, the most costly part of the pilot program was test development, accounting for 72 percent of the cost of the pilot program in English and 61 percent of the pilot program in mathematics. When the other approaches to final exams are considered, development remains the most costly item. Only for teacher-made examinations in mathematics does this pattern change. Here, only 28 percent of the cost is attributable to development. This may well be because prototypes for such tests readily accompany most mathematics texts as well as the MCPS curricular guides.

- Large differences are found in the costs of scoring. Costs for scoring are proportionally lower for the pilot program than the other alternatives. In English, the percentage of total costs related to scoring is 16 percent for the pilot program, compared to 28 percent for the other departmental exams and 24 percent for the teacher-made exams. In mathematics, the comparable figures are 21 percent for the pilot program, compared to 30 percent for other departmental exams and 62 percent for teacher-made exams. The apparent cost savings in the pilot program are largely attributable to the use of multiple choice machine-scoreable answer sheets (Scantron) for the uniform countywide portion of the tests and for some of the tests used for the departmental portions.

These findings suggest that many students are given tests in these three courses consisting mostly of multiple choice questions. When asked why the departmental portion of many of the pilot program exams were mostly multiple choice items, the most common response was that the short timeline between administering these tests and submitting grades precluded the use of many essays, proofs, and other forms of constructed responses.

TABLE 3

Relative Costs of Development, Preparation, Materials, and Scoring for English*

	Development %	Preparation %	Materials %	Scoring %
Total Countywide Exam	72	12	1	16
Uniform Portion	71	10	3	16
Dept. Portion	72	12	.4	16
Other Dept. Exam	62	10	1	28
Teacher-made Exam**	66	9	1	24

*Assumes an enrollment of 3,400 students, the actual enrollments of Introduction to High School English and Narrative-Drama as Literature I in the fall of 1982.

**This assumes there is an average of two teachers per school teaching a course.

TABLE 4

Relative Costs of Development, Preparation, Materials, and Scoring For Mathematics*

	Development %	Preparation %	Materials %	Scoring %
Total Countywide Exam	61	16	2	21
Uniform Portion	61	23	7	10
Dept. Portion	61	14	1	24
Other Dept. Exam	54	15	1	30
Teacher-made Exam**	28	9	1	62

*Assumes an enrollment of 5,600 students, the actual enrollment of Geometry B in the spring of 1982.

**This assumes there is an average of two teachers per school teaching a course.

PROJECTED COSTS

Using the data obtained above, costs were projected for implementing final examinations in all courses for English and mathematics. Tables 5 and 6 present these calculations. The tables show that for a single semester the cost of providing uniform countywide and departmental examinations would be ~~$781,019~~ $766,082 for all English courses and $339,977 for all mathematics courses (or a total of $1,106,059 per semester).[1] If we compare these figures to the cost of teacher-made exams, we find that the current plan costs approximately 250 percent as much as would one involving teacher-made exams alone. If we did not have uniform countywide exams but relied solely on departmental exams, we would still find such a system about 70 percent more costly than using teacher-made exams alone.

In examining the cost figures, it must be pointed out that despite the apparent costliness of the pilot program the numbers presented may well be underestimates of what a full-fledged program designed to fulfill the intent of Senior High Policy would cost. That is, if the pilot program is to provide data for program monitoring, the test data produced by each school should be aggregated and analyzed so that instances in which scores are particularly low can be thoroughly explored. The program at present is too new to know a) exactly how this might best be done and b) how much such activities will add to the estimates provided in this paper. Preliminary explorations of this question suggest, however, that some complex technical and conceptual problems will have to be resolved.

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1. It should be noted that the cost of the pilot program is not greatly affected by either the actual enrollment in courses or fluctuations in enrollment because of the relatively large portion of the cost attributable to development (which is not affected by course enrollments) and the small proportion attributable to materials and scoring.

TABLE 5

Projected Total Cost of Three Types of Final Examinations in English*

		Total Cost
Total Countywide Exam		$766,082
Uniform Portion	307,648	
Dept. Portion	458,434	
Other Dept. Exam		442,846
Teacher-made Exam**		292,974

*This assumes 30 courses offered countywide and 10 courses offered per school.

**This assumes two teachers per course in each school.

TABLE 6

Projected Total Cost of Three Types of Final Exams in Mathematics*

		Total Cost
Total Countywide Exam		$339,977
Uniform Portion	103,555	
Dept. Portion	236,422	
Other Dept. Exam		218,356
Teacher-made Exam**		159,063

*This assumes 16 courses offered countywide and 10 courses offered per school.

**This assumes two teachers per course in each school.

ADDITIONAL CONSIDERATIONS

In examining the cost figures presented above, it must be pointed out that in most cases they do not represent incremental or out-of-pocket costs, but rather opportunity costs. That is, if the teachers were not preparing exams they would be doing something else with that time. Only the materials costs, ranging from 1 to 7 percent, represent true additional costs to the school system. Therefore, one should not be mislead into thinking that elimination of one or more parts of the exam process would result in substantial actual dollar savings to the school system. Rather, the real question is whether or not it is cost effective to spend MCPS resources as the system is now doing, or whether the resources would be better used in some other way.

In addition, the data that have been presented here provide a very unidimensional look at a multidimensional picture. They do not tell whether the current plan is having any effect on the consistency of instruction across or within different schools nor whether the information provided by the pilot program is either used or useful for program monitoring. Comments received from respondents showed that participating staff themselves had differing views of the value of the program. Some felt that the exams definitely were useful and praised their quality. In fact, they expressed the desire to have access to the test items for their own use. Others felt the uniform countywide exams were too easy and did not measure what the students had learned.

Finally, far too little is known about the relative strengths and weaknesses of approaches other than the current pilot program which could also promote program consistency across schools. There may well be some alternative ways in which departmental or teacher-made exams could be used for this purpose. For example, uniformity could be assessed by analyzing the content and coverage of objectives in final exams in a limited number of courses each year. Also, item pools covering selected objectives might be made available to be incorporated into locally generated tests, with performance on these items compared across schools. Clearly, neither of these alternatives would eliminate the costs of test development or get around the problem of allocating resources to the analysis of the exams and the data produced. They might well cut down, however, on the spiraling costs that have been documented here.

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TECHNICAL APPENDIX

This appendix provides some background information as to how the analyses of exam costs were organized and carried out. The first section describes the types of exams that were compared in the report. The second section lists the various kinds of data that were used. The third section discusses the data sources. The final sections provide details on how the data were summarized.

Types of Exams

Three types of final exams were studied.

1. The countywide exam is divided into a uniform countywide portion and a school departmental portion.

   a. The uniform countywide portion is the half developed by the Department of Academic Skills and is administered in all schools.

   b. The departmental portion is the half developed by each school and is unique to each school.

2. Other departmental exams are developed by each department in each school for courses that are not part of the countywide exam pilot.

3. Teacher-made final exams are those developed by an individual teacher. Because all finals in major subjects must be departmentalized, these exams represent exams written for subjects in a school for which there is only one teacher teaching all of the course's sections.

Categories of Cost Estimates

Costs were divided into four components. The factors considered in each are described below.

1. Development

   a. School costs--teacher and/or resource teacher time to write the exam, meeting time to discuss how the writing will be done, time to review the final product.

   b. County costs--EYE teacher, teacher specialist, coordinator, and consultant time to write the items for each test.

2. Preparation

   a. School costs--teacher, resource teacher, secretary, and/or aide time to type, proof, run off, and collate the exams; time to prepare materials for review that were necessary beyond what teachers would normally do for an exam period; time to get all materials (tests, pencils, paper, answer sheets, etc.) ready for teachers to administer the test.

b. County costs--typists and clerical time for aiding the item writers; labor involved in printing and distributing the tests.

3. Materials

a. School costs--paper for printing tests, scrap paper, answer sheets
b. County costs--workshop materials, materials involved in printing, answer sheets

4. Scoring

a. School costs--teacher, resource teacher, and/or aide time to score tests either on a scanning machine or by hand; time to analyze results.

b. No county scoring was done.

Sources of Data

The information used to make the cost estimates came from a variety of sources. Development and part of the preparation and materials costs for the uniform countywide portion were obtained from subject coordinators in the Division of Academic Skills, from Publications Services, and from the Division of Supply and Property Management. Scoring costs and part of the preparation and materials costs for the uniform portion were obtained from interviews of resource teachers and regular teachers.

All of the costs for the other exams were obtained from interviews with resource teachers and other teaching staff. These interviews were conducted in nine schools in each subject--three at the junior high and six and the senior high levels. All three administrative areas were equally represented.

The math teacher interviews focused on the experience of administering the Geometry B exam in June, 1982. Information was also collected on what was anticipated for Geometry A and Algebra 1A in January, 1983. The English interviews focused on new English exams in Introduction to High School English and Narrative-Drama as Literature I, looking at both experience in development and expectations for administration in January, 1983. In these interviews teachers were also asked about departmental or teacher-made exams in other subjects.

All of the interviews were aimed primarily at determining the time spent by various staff members on tasks related to each type of exam. This time was transformed into dollars by using average salaries supplied by the Department of Personnel Services. All salary figures were increased by a factor of 30 percent to cover overhead such as fringe benefits, equipment maintenance, electricity, etc.

Computation of Costs

The data obtained from each respondent were aggregated to produce average costs for each type of test. This was done in two ways. Development and preparation costs were determined on a per examination basis on the assumption that they would not vary as a function of the number of students enrolled in a course. Costs for materials and scoring costs, on the other hand, were adjusted for course enrollments as they are directly related to this factor. Presented in the following sections are brief summaries of how these averages were computed:

Calculating Development and Preparation Costs

Overall development and preparation costs of the countywide uniform portion were computed by totaling the summer 1982 EYE costs for item writing workshops and one-fourth of the salary for the subject coordinators in English and math. However, since staff produced two exams for each of several courses, the following algorithm was used to develop cost estimates for a single test. First, total staff costs were divided by the number of courses covered, 9 for math and 16 for English. Second, the cost of a single exam was estimated by taking the per course average and discounting it by 30 percent. The per course average was not simply halved because it was felt that the development of a single exam is proportionally more costly than that of two. Start-up costs such as training item writers, planning, and allocation of responsibilities contribute to this difference.

For the other three types of exams, the procedures were slightly different, and it was necessary to make some adjustments in order to make the data comparable to that obtained for the countywide portion. Development and preparation costs were determined by using the average costs per exam provided by the teachers in the interview sample. It was assumed that this average was representative of all schools in the county. Thus, to determine total county development and preparation costs, this average was multiplied by 35, the number of schools in the county having at least one grade between 9 and 12. The cost per school for teacher-made exams was doubled on the assumption that there would be an average of two teachers per course in a school if they were serving the same number of students as the courses included in the pilot program. Further, it was assumed that these teachers would develop their exams independent of each other.

Calculating Materials and Scoring Costs

Materials and scoring costs were based on the average per student cost determined from the teacher interviews. To compute this average, the total costs for all of the sample schools were determined in English and math. For the Other Departmental and Teacher-made Exams, these costs came from different courses in each school. The enrollments in these courses in each school were then totaled. The sample total cost for each type of exam was divided by the sample total enrollment for each type of exam to get the averages for each subject area. To make these data more comparable with those for the pilot program, the averages were multiplied by the countywide enrollment in Geometry B (5,600) and Introduction to High School English or Narrative-Drama as Literature I (both 3,400). For

the countywide uniform exams, materials costs from the print shop were added in.

Calculating Cost Projections

The computation of the different kinds of cost discussed above made it possible to project the total cost of each type of exam for a semester for all courses in English and mathematics. The development and preparation costs for the countywide uniform exam for the projection for all courses were determined by multiplying the per exam average discussed above by 16 in math and 30 in English. These numbers represent the number of courses offered countywide in each of those areas in the fall of 1982. For the other exams, the development and preparation costs were derived by multiplying the costs for one exam by 10 because the average number of courses offered per school is 9.7 in math and 9.5 in English. Materials and scoring costs for this projection were determined by multiplying the per student cost by the number of students enrolled in the 16 math courses and 30 English courses in the fall of 1982.

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